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XLIX. *Observations and Experiments tending to confirm
Dr. Ingenhoufz's Theory of the Electrophorus; and to
shew the Impermeability of Glafs to Electric Fluid.*
By William Henly, F. R. S.

Read July 9, 1778. **D**R. FRANKLIN has observed, " That
" there is a great quantity of the elec-
" trical fire in glafs; that what it has it holds; and that
" it has as much as it can hold: that what is already in
" it refuses, or strongly repels any additional quantity:
" that when an additional quantity is applied to one sur-
" face of a phial (for instance, by the atmosphere of an
" excited tube) a quantity is repelled or driven out of the
" inner surface of that side into the vessel, returning
" again into its pores, when the excited tube with its at-
" mosphere is withdrawn; and that the particles of that
" atmosphere do not themselves pass through the glafs."

The following experiments, I think, remarkably il-
lustrate this, by shewing that bodies are very differently

affected by a fluid acting immediately upon them *through glafs*; or by acting upon them immediately *by the glafs*, as above mentioned.

E X P E R I M E N T.

A circular box, three or four inches in diameter, and a quarter of an inch deep, is furnished with a thin glafs for a top. In this box scatter some very small steel filings, or sift them into it through a piece of writing paper, which has a number of holes pricked through it with a pin. Then apply one of the ends of a magnetic bar to the upper surface of the glafs; the filings will be instantly attracted to the glafs, and remain there as long as the magnet is thus suspended over them; but the moment it is removed, the filings fall to the bottom of the box, and there remain at rest. The glafs then being made perfectly clean and warm, let a fine piece of amber, sealing wax, &c. be strongly excited and applied to it as the magnet was in the former experiment; the filings will be instantly in motion, and will continue so for some seconds. When their motion ceases, withdraw the amber, &c. and the motion of the filings will be renewed, and continue as at first; this shews, I think, that in

both cases, they really act as conductors of the electric fluid between the lower surface of the glass and the bottom of the box, in order to restore an equilibrium, as upon Dr. FRANKLIN's principles they ought to do; and that the electric fluid does not, like the magnetic, absolutely permeate the glass.

E X P E R I M E N T.

Take a clean, dry, thin phial, about four inches long, and one inch in diameter. In the cork of this phial fix a small loop of very fine iron wire. In the loop suspend another wire, about two inches and an half in length, by a similar loop; and on the lower end hang a light round ball of the pith of elder or cork, and be careful to give the wire as free a motion as possible. Let one of the ends of a small magnetic bar be brought near the side of the phial, and the little ball will instantly come to the glass, and there remain as long as the magnet is held within the distance of its influence. Remove the magnet, and the ball instantly retires to, and remains in the center of the phial: then dry and warm the glass, and let an electric strongly excited be applied to the side of the phial, as the magnet was in the former experiment; the

ball instantly comes to the side of the glass, and there remains some seconds, and then returns to the center of the phial. Withdraw now the excited electric, and the ball instantly returns to the glass upon the principle before mentioned, which is more completely shewn by the filings in the little box.

EXPERIMENT.

Let a piece of thin glass be placed as a cover to a circular box, about six inches in diameter, and three quarters of an inch deep: put into the box twenty or thirty light balls of cork, or of the pith of elder; then, having made the glass very dry and warm, expose the surface of it to the electric matter issuing from the prime conductor to a good electrical machine, the balls will be instantly in motion, and will so continue for some time, the box being moved in such manner that every part of the glass may be affected. Then remove the box, and the balls being at rest, turn the glass, placing the upper surface downward; the balls will then instantly renew their motion. When this second motion ceases, touch the surface of the glass near the center with a finger, or, which is better, with a round, smooth piece
of

of wood or metal, the balls will instantly fly to either of these, and will frequently pile themselves up between the glass and the bottom of the box, eight or ten in a pile, and will remove themselves, following the wood, &c. to different parts of the glass, till the charge is exhausted. Apply the glass again to the conductor as before, and when the motion of the balls nearly ceases, remove the glass, and place on each surface a circular coating of metal, reaching within an inch of the edge of the glass all round. Make a communication between these coatings, and the glass will then shew that it has been charged, and will give a very strong shock: this proves, that the electric matter did not absolutely pass through the glass, but only acted on the electricity inherent in it in the manner explained by Dr. FRANKLIN.

The direction of the electric matter, in the discharge of the Leyden bottle, hath been shewn in a variety of methods (see *Philosophical Transactions*, vol. LXIV. and LXVII.); but I shall here mention one which, I think, a very curious addition to the number. Mr. LULLIN, of Geneva, placed two wires, the one upon, the other under, a card, the ends of the wires, in contact with the card, being about an inch from each other. This apparatus

ratus being made a part of the circuit, a charged bottle of a proper size was discharged through it: when the charge passed along the surface of the card from the end of that wire into which it was discharged, till it came to the end of the other wire, and there pierced a hole through the card, passing by that wire to the negative side of the bottle; and this happened whether the bottle was charged positively or negatively. A learned and ingenious correspondent of mine, the honourable FREDERIC CHRISTIAN MAHLING, counsellor of state at Copenhagen, has improved this experiment, by first painting the card in a line about half an inch broad on each surface with vermilion. The charge passing in this line (the card being previously well-dried) shews its passage by a black mark on the vermilion, the mark being on one side of the card when the bottle is charged positively, and on the other side of it when the bottle is charged negatively. To which I would add, that a line of light is seen upon one surface of the card through the whole space between the ends of the wires in one case, for instance, when the bottle is charged positively. But no light is seen in the other case, that is, when the bottle is charged negatively, till the electricity bursts a hole through the card to get at the wire which is in contact
with

with the negative side of the bottle, as in this case the charge passes along the under surface of the card. If the card be placed vertically between two insulated wires, as in the universal discharger, described in Mr. CAVALLO's Treatise on Electricity, the experiment may be made with great facility and certainty. The card may be fixed on a bit of sealing wax, or set in a piece of wood, sawn to a proper depth with a fine tenon saw.

